SIXTEENTH ANNUAL REPORT

OF THE

OREGON AGRICULTURAL COLLEGE

AND

EXPERIMENT STATION

FOR THE YEAR ENDING

JUNE 30, 1904

Agricultural College Press
1904

Board of Regents of the Oregon Agricultural College and Experiment Station.

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OFFICERS OF THE STATION.

STATION STAFF.

Thos. M. Gatch, A. M., Ph. D.....*President.*
James Withycombe, M. Agr.....*Director and Agriculturist.*
A. L. Knisely, M. S.....*Chemist.*
A. B. Cordley, M. S.....*Entomologist.*
E. R. Lake, M. S.....*Horticulturist and Botanist.*
E. F. Pernot, M. S.....*Bacteriologist.*
George Coote.....*Florist.*
F. L. Kent, B. S.....*Dairying.*
C. M. McKellips, Ph. C., M. S.....*Chemistry.*
F. E. Edwards, B. M. E.....*Chemistry.*
H. D. Gibbs, B. S.....*Chemistry.*

SIXTEENTH ANNUAL REPORT

OF THE

OREGON AGRICULTURAL COLLEGE AND EXPERIMENT STATION,

REPORT OF THE PRESIDENT OF THE BOARD OF REGENTS.

Hon. George E. Chamberlain, Governor of the State of Oregon.

I have the honor to submit a report of the work done at the State Agricultural College and Experiment Station for the year ending June 30, 1904.

The year just closed has been a very successful one. The attendance has been very satisfactory, and the work done by Professors and students has been such as to reflect credit upon the institution and to redound to the benefit of the State of Oregon. For a detailed statement of the work done in the College, I refer you to the report of the President of the College and the Professors at the heads of the various departments made to the Board of Regents which accompany this report and are made a part of it.

The Secretary of the Board, in his report shows the financial condition of the College, which, I am glad to inform you, is good.

As shown by the report made one year ago, there is received from the General Government under what is known as the Morrill Act, $25,000.00 annually, and from the Hatch Act $15,000.00 annually,

and from the interest accumulated on the irreducible fund, which fund is derived from the sale of lands given to the State by Act of Congress approved July 2, 1862, which is for the present year $10,943.36, making a total received from these three sources of $50,943,36. This fund is substantially sufficient to pay salaries and the ordinary expenses of the College. It becomes necessary, however, for the State to provide all buildings and plants necessary to carry on the work of the College and Experimental Station.

The money derived from the "Hatch Act" can be used only to aid in acquiring and diffusing among the people of the State useful and practical information on subjects connected with agriculture and to promote scientific investigation, and to experiment respecting the principles and application of agricultural sciences. And it is made the duty of each experimental station to conduct original researches or verify experiments on the physiology of plants and animals, and diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects of crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States, as may in each case be deemed advisable. In accordance with the provisions of this law, the Station has, during the year just closed, issued bulletins on the following subjects: "Canning Cheese" by Prof. E. F. Pernot; "Strawberries and Varieties of Vegetables" by Prof. Geo. Coote; "Swine Feeding" by Dr. James Withycombe; "Plant Food" by Prof. A. L. Knisely; "The Apple in Oregon" by Prof. E. R. Lake. These have been sent free to a great many people engaged in farming in the State of Oregon and any one desiring the bulletins can have them upon furnishing the Secretary their names and addresses. These bulletins should be more generally distributed and would be furnished to every one in the State of Oregon if their names and addresses were furnished to the Secretary. Much valuable information can thus

be disseminated, especially to those engaged in the agricultural pursuits.

I am pleased to say that during the past year Dr. Allen, Chief Assistant in the supervision of the Experiment Stations of the United States at Washington, D. C., made an official visit of investigation to the Station, examined the accounts and looked over the work done. He seemed to be much pleased with the work of the Station and complimented those in charge of it. He gave it as his best judgment that it was doing a useful and practical work and one that must be of great benefit to the agriculturists of the State. I have no doubt that his report will place the Station in the front list of the Stations of the United States in developing the latent resources of the soil and the products thereof.

The money used under the Morrill Act can be used only for instruction in agriculture, the mechanical arts, the English language, mathematics, physical, natural and economic sciences with reference to their application to the industries of life, and facilities for such instruction.

For the purpose of carrying out the first requirement of the Act, that of instructing in agriculture, there has been, within the last two years, erected a large building which is supplied with the necessary equipments for instruction in the various branches connected with the agricultural course. During the year just closed the Board has made an expenditure of $6,000.00 to furnish the Agricultural building with the latest and best appliances for that purpose. The chemical department is probably the best on the Pacific coast and is pronounced by men of experience to be equal to any of the colleges in the older and larger States.

The dairying department is also supplied with the latest and best improved machinery and appliances necessary for instruction in this most important industry.

It may appear to the casual observer that the number of students taking the agricultural course is small compared to the number of students in attendance at the institution. The percentage, however, of students enrolled in the agricultural department during the past six years has been larger in Oregon than in most other States. The following table which I have collated from the reports made to the Commissioner of Education shows the number of pupils enrolled in the agricultural departments of the Agricultural Colleges of the different States:

States.	Population.	No. Students in Agricultural Department.
Alabama	1,828,697	97
Arizona	122,831	
Arkansas	1,311,564	10
California	1,480,063	61
Colorado	528,700	47
Connecticut	908,420	62
Delaware	184,735	8
Florida	528,542	41
Georgia	2,116,331	43
Idaho	161,772	
Illinois	4,821,550	203
Indiana	2,516,462	120
Iowa	2,231,853	194
Kansas	1,470,495	341
Kentucky	2,147,174	6
Louisana	1,581,626	37
Maine	694,466	18
Maryland	1,188,044	19
Massachusetts	2,805,356	224
Michigan	2,420,982	293
Minnesota	1,751,374	619
Mississippi	1,551,270	478
Missouri	3,106,665	145
Montana	243,329	24
Nebraska	1,066,300	11
Nevada	42,335	1
New Hampshire	411,588	51
New Jersey	1,883,689	57
New York	7,268,894	92
North Carolina	1,893,810	72
Ohio	4,157,545	49
Oregon	413,536	64
Pennsylvania	6,302,115	43
Rhode Island	428,556	6
South Carolina	1,340,316	47
South Dakota	401,570	43
Tennessee	2,020,616	46
Texas	3,048,710	206
Utah	276,749	22
Vermont	343,641	40
Virginia	1,854,184	35
Washington	518,103	6
West Virginia	958,800	37
Wisconsin	2,069,042	297
Wyoming	92,531	11

It will be seen from the foregoing table that Oregon, according to its population, has as large attendance in the agricultural department as any other State excepting Kansas, Minnesota and Mississippi. Some of the States have registered all their male students in the agricultural department, while they only take a short course in that branch. The Oregon Agricultural College prescribes a four years' course, known as the Agricultural course, and is as thorough as any given in like schools. The Board realizes that the farmer, in addition to a fundamental education, which every one should have, should be educated in the sciences, elementary engineering, mechanics and agriculture. A person who has charge of any business should understand the business both theoretically and practically. This is true especially of the farmer. His knowledge

of principles should be such as to enable him to determine at once the comparative values of different processes of work or to invent new ones when emergencies require. He should be able to reach just conclusions by a knowledge of the underlying principles, and not slowly by trial and experiments. It has been the object and aim of the Board of Regents to give the opportunity to each and every student who enters the College to become master of one or more of the departments required to be carried on by the organic law under which Agricultural Colleges were created. Many students from the farm desire to take a mechanical course, trusting that the mechanical course and the practical knowledge they have of agriculture, and such theory as is taught in the college course would enable them to better carry on their life-work than the agricultural course alone would or could do.

The first Morrill Act approved July 2, 1862, requires instruction to be given in military tactics and for this purpose a commandant is designated by the Secretary of War and assigned to duty at the Agricultural College for the purpose of giving instructions in this department. We have been very fortunate in securing the services of Major C. B. Hardin, 20th U. S. Infantry, for the past year. We are informed, however, that he has been ordered to report to his regiment for service. We presume that some suitable person will be designated by the Secretary of War to take his place. This department has been of inestimable benefit to the young men attending the College in a great many particulars. It improves their habits and develops them physically, gives them a military knowledge which it is desirable that every citizen should possess.

The Cadet band is under the instruction of a competent officer and leader. The armory contains a drill-room of 70x100 feet in extent. The College is provided with 300 Springfield rifles with equipments; two light field pieces; and twenty cavalry sabers. During the past year there were four organized companies, each company having a full complement of officers and the number enrolled is something over three hundred.

The department of household science has grown to such proportions, and we believe that it is destined to increase to such an extent that it will become imperative to secure a more adequate building for that purpose. In our judgment it is a very important factor in an Agricultural College or any other practical school. The young ladies in attendance at the school realize the value to be de-

rived from a theoretical and practical knowledge of household economy.

But one of the greatest aims and objects of the College is to educate each and every student that enters its halls in English language and literature, history of the Government and the necessary sciences to make them useful citizens irrespective of the calling they may follow in after life, and to prepare them for the strong competition with which they will meet in every department. This can be done only by giving each man a knowledge of all the branches of his work.

THE EASTERN OREGON STATION.

The work initiated at this Station immediately after the passage of the Legislative Act creating it, is being carried forward with promise of excellent results. The grasses and forage plants, so far as developed at this Station, are more than a success. We feel as though this work will greatly benefit the State and especially the eastern portion of it.

Professor Leckenby, who was in charge of this Station and initiated the work, resigned in January, 1904, and Mr. George Gammie was selected and placed in charge of the Station. During the Fall and Winter coming he will take up the experiment of fattening range cattle and other stock, making tests of various kinds of feed, the manner of caring for them, the relative cost of each, which will from time to time be published in bulletin form for general distribution.

Respectfully,

J. K. WEATHERFORD, President.

TREASURER'S REPORT.

CORVALLIS, OREGON, July 20, 1904.

To the Honorable the Board of Regents, Oregon Agricultural College:

GENTLEMEN:—Herewith I submit my report for the year ended June 30, 1904. The vouchers and other evidences of payment are on file in the office of the Clerk and Purchasing Agent.

Very respectfully,

B. F. IRVINE, Treasurer.

BALANCE ON HAND JULY 1, 1903.

Improvement	$ 183.20	
Chemical Breakage	415.00	
Local Station	3.34	
Special	4,682.42	$5,283.96

INCOME FOR THE YEAR.

Station—Hatch	$15,000.00	
College—Morrill	25,030.00	
State Interest	10,943.36	
Improvement	589.40	
Chemical Breakage	860.45	
Local Station	1,704 79	
Special	25,018.64	$79,146.64
Total available funds		$ 84,430.60

DISBURSEMENTS.

Station	$15,000.00	
College	25,030.00	
State Interest	10,943.36	
Improvement	497.81	
Chemical Breakage	1,111 81	
Local Station	1,636.72	
Special	29,679.43	$83,899.13
Balance		$ 531.47

BALANCES BY FUNDS.

Improvement	$ 274 79	
Chemical Breakage	163.64	
Local Station	71.41	
Special	21.63	$ 531.47

MISCELLANEOUS RECEIPTS AND THEIR DISTRIBUTION.

Source.	Amount.	Local Station.	Improvement.
Agriculture	$ 864.35	$ 864.35	
Dairy	767.72	767.72	
Horticulture	40.90	40.90	
Miscellaneous	621.22	31.82	$ 589.40
Totals	$2,294.19	$1,704.79	$ 589.40

DISBURSEMENTS BY SALARIES, INCIDENTALS, TOTALS.

DEPARTMENT OR ITEM.	SALARIES.	INCIDENTALS.	TOTALS.
Printing	$ 1,690.00	$ 1,149.89	$ 2,839.89
Agriculture	3,080.00	3,610.43	6,690.43
Horticulture	1,080.00	2,636.87	3,816.87
Botany	1,600.00	81.70	1,681.70
Chemistry	5,064.00	2,378.80	7,442.80
Chemical breakage		1,111.81	1,111.81
Bacteriology	1,600.00	55.70	1,655.70
Entomology	2,680.00	245.44	2,925.44
Mechanics	4,174.55	804.25	4,978.80
Household economy	1,560.00	136.77	1,696.77
Military	108.00	115.27	223.27
Library	400.00	821.56	1,221.56
Drawing	830.00	.....	830.00
Salaries outside departments	16,778.20	.....	16,778.20
Sanitary		233.00	233.00
Furuiture		7.00	7.00
Traveling expenses		943.90	943.90
Advertising		176.90	176.90
Fuel		1,794.81	1,794.81
Insurance		48.00	48.00
Postage		347.20	347.20
Freight		633.58	633.58
Telephones and telegrams		115.15	115.15
Scientific apparatus		682.94	682.94
Tools and machinery		2,487.40	2,487.40
Building repairs		1,062.38	1,062.38
Miscellaneous labor		1,631.44	1,631.44
Miscellaneous supplies		433.88	433.88
Cauthorn Hall		439.34	439.34
Alpha Hall		54.30	54.30
Agricultural Hall—Furnishing		6,459.75	6,459.75
Miscellaneous and current		1,869.82	1,869.82
Live stock		575.00	575.00
Heating plant—consolidation		4,010.09	4,010.09
Real estate		6,000.00	6,000.00
Totals	$40,644.75	$43,254.38	$83,899.13

TREASURER'S ACCOUNT—FACE OF LEDGER.

FUND.	DR.	CR.	BALANCES.
Station	$15,000.00	$15,000.00	.....
College	25,030.00	25,030.00	.....
State Interest	10,943.36	10,943.36	.....
Improvement	772.60	497.81	274.79
Chemical Breakage	1,275.45	1,111.81	163.64
Local Station	1,708.13	1,636.72	71.41
Special	29,701.06	29,679.43	21.63
Totals	$84,430.60	$82,899.13	$ 531.47

REPORT OF THE FINANCE COMMITTEE.

CORVALLIS, OREGON, July 20, 1904.

To the Board of Regents:

GENTLEMEN:—We your Finance Committee would respectfully report that we have examined the books and vouchers in the office of the Clerk and Purchasing Agent of the College and Station and we find the same well kept, neat and correct.

We have checked up all the drafts and compared them with the priginal receipted bills on file, and we have found them correct as set forth in the report and books of the Clerk.

We have examined the report of the Treasurer of the Board for the year ended June 30, 1904, and find it correct as to the amount of money to be accounted for, and the receipts and disbursements are found to be correct and agree with the books and vouchers on file in the office of the College and Station.

We find that there has been expended on account of the College during the year $48,306.27; there has been expended on account of the Station during the year $16,636.72; there has been expended as per action of the Board and the Building and Grounds Committee to whom the Board entrusted the expenditure of certain moneys, $18,956.14.

Respectfully submitted,

J. T. APPERSON,
W. E. YATES,
B. G. LEEDY,
Finance Committee.

FINANCIAL ACCOUNT.

Oregon Agricultural Experiment Station, in account with the United States Appropriation, 1903–1904.

DR.

To receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1904, as per act of Congress approved March 2, 1887	$15,000.00

CR.

By Salaries	$10,530.00	
Labor	2,398.02	
Publications	240.17	
Postage and stationery	63 53	
Freight and express	99.26	
Heat, light, water, and power		
Chemical supplies	166.42	
Seeds, plants, and sundry supplies	294.61	
Fertilizers	30.25	
Feeding stuffs	377 47	
Library	80.41	
Tools, implements, and machinery	351.84	
Furniture and fixtures		
Scientific apparatus		
Live stock		
Traveling expenses	334.30	
Contingent expenses	33.72	
Buildings and repairs		
		$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Oregon Agricultural Experiment Station for the fiscal year ended June 30, 1904; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $15,000.00, and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the act of Congress approved March 2, 1887. Signed:

J. T. APPERSON,
B. G. LEEDY,
W. E. YATES,
} Auditors.

SUPPLEMENTARY REPORT.

LOCAL STATION FUND.

Balance on hand July 1, 1903	$ 3.34	
Received from sale of farm products, etc	1,704.79	
		$ 1,708.13

DISBURSEMENTS.

Labor	$ 605.25	
Publications	107.00	
Freight and express	20.00	
Chemical supplies	24.58	
Seeds, plants, and sundry supplies	223.84	
Feeding stuffs	243.94	
Live stock	125.00	
Traveling expenses	257.80	
Contingent expenses	29.31	
		$1,636.72
Balance		$ 71.41

REPORT OF THE PRESIDENT.

To the Honorable Board of Regents of the Oregon Agricultural College and Experiment Station:—

GENTLEMEN:—I submit herewith my report for the collegiate year ending June 15, 1904.

ATTENDANCE.

The enrollment amounted to 530 students, 11 less than that of the preceding year. The decrease, though small, is noticeable because for several years there had been an annual increase of 10 or 12 per cent. I find the enrollment in some other colleges was not so large as in the preceding year. Doubtless many young men remained away from school to take advantage of the unusually high wages that prevailed.

We ought to add that our attendance during the last term was larger than that of the last term of the preceding year, or of any other third term in the history of the College.

RESIGNATIONS.

As the College year was about to begin resignations were received from Mr. Prichard, instructor in woodwork, and from Professor McLouth, director of the art department. As this department under the instruction of Professor McLouth has attained to a high degree of proficiency great care was necessary in choosing a successor. In the emergency I telegraphed Mrs. Claire Gatch Wheeler of Seattle, who has taught drawing for several years in the University of Washington, asking her to organize the classes and instruct them till a suitable teacher could be employed. Mrs. Wheeler came immediately and had charge of the department for one month. In the meantime Miss Belle Williams, a graduate of the art department of Pratt Institute, was employed at $80.00 a month for the College year. Miss Williams is a faithful and painstaking instructor.

The woodwork was placed in charge of Mr. Elmer Jackson, a member of our senior class, who rendered efficient service.

Miss Chamberlin having been granted leave of absence for one year, Doctor Alfred C. Schmitt was appointed to take charge of her classes. At the close of the second term business affairs justified Doctor Schmitt in asking to be released from the engagement. The Doctor is a thorough, as well as a popular instructor, and his resignation was greatly regretted by faculty and students. His classes

were distributed among Professors Berchtold, Horner, Callahan and Fulton. Owing to the aid so generously granted by these professors our work was not interrupted.

I call the attention of the Board to the fact that our Commandant, Major Hardin, of the 20th Infantry, has been ordered to join his regiment in the Philippines.

"RHETORICALS."

Members of the Junior class are required to write orations, submit them to the professor of English for criticism and correction, and then be trained in delivery by the professor of elocution. Believing that this exercise, although commendable, should be supplemented by work of a more extemporaneous character, public debates have of late been encouraged. The literary societies have conducted a series of spirited debates which have awakened quite an interest, calling out good audiences. During the last half-year we could have organized a debating team able to cope with teams from almost any college.

ATHLETICS.

Some think that athletics should be encouraged for the sake of the training and exercise they afford, irrespective of the question of victory over other teams. Some of us are not so constituted as to be influenced only by these high, moral considerations.

It is with great satisfaction I inform the regents that our College has, at last, gained a position in the very front rank of the athletic field. To the truth of this assertion the banner on the wall of the President's office bears witness. This and many other trophies were brought home from the indoor track and field meet held at Columbia University April 16, 1904. Other victories during the year afforded agreeable relief from the monotony of College routine.

MUSIC.

Our department of music under the instruction of Mrs. Green, Mr. Goodnough and Mr. Turney has greatly prospered. Mr. Goodnough has resigned to take a position in a Portland institution. In his place we have secured the services of Professor G. Taillandier who has studied in Germany and America and has had extended experience in teaching. He is highly recommended, not only in the usual style of recommendations but by one of our own advanced music pupils who has lately been under his instruction in the East.

THE CAMPUS.

An unusual amount of work has been done on our grounds. The

campus speaks for itself. It is without doubt the finest in the Northwest.

LIBRARY.

From the report of Mr. R. J. Nichols, librarian, we learn that 626 books have been added to the library the past year. Of this number 376 were selected and purchased while 250 were donations, principally from the government. These have all been labeled and catalogued. Forty monthly and twenty-five weekly publications are paid for. Others, mostly of an agricultural character, are furnished gratuitously. Total cost of books, magazines and papers for the year, $821.56.

During the year an average of 25 books a day have been drawn from the library. Reports five and six years back show that only six books daily were taken from the library. After allowing for increased attendance we see that the library is more highly appreciated than in former years.

I would ask permission of the Board to have a door-way made between the library and the room that has been used as a quantitative laboratory. This can be done without injury to the wall. In former years there was a door in this place as is plainly indicated by the lintel and arch and the wooden blocks to which the casing was fastened. Our great need is more shelf-room. In the crowded condition of our library, proper filing and classification are impossible. The addition suggested would supply all the room we would probably need till the Board is able to put up a properly constructed library building.

WATER SUPPLY.

The four new wells, sunk near the heating plant, furnish 9000 gallons during a day of 16 hours. The flow is not irregular as in the old well but remains the same winter and summer. This is a great help, but all our supply is not adequate to the needs of our College. Those having experience in such affairs assert that there is plenty of water in the wells but the pump as at present arranged cannot force the water into the pipes.

GRADUATES.

At our Commencement, June 15, 1904, thirty-five candidates having completed their courses of study, received the degree of Bachelor of Science. I hope their graduation can be approved by the Board and thus become a matter of record. Their names, with the titles of their theses, are as follows:

HOUSEHOLD SCIENCE.

The Construction, Sanitation and Ventilation of a Modern Farm House...Carrie Ann Byerlee
The Butterflies of Oregon.....Maud Elizabeth Cochran, Clara Etta Fuller
Literature of the Pacific Coast.....Lucy Aramintha Dilley
Influence of Epochs Upon English Literature.....Inez St. Germain
Literature of the First Half of the Nineteenth Century.....Mary Elizabeth Sutherland
Tabulated List of the Flowering Plants on a Benton County Farm.....Isabel Harris Whitby

AGRICULTURE.

Micro-Organisms of the Soil.....John Charles Burns
Botanical and Chemical Analysis of Hops.....Claude Cliffton Cate
A Chemical Study of Some Oregon Forage Plants.....Jesse Claude Clark
Mechanical Analysis and Comparison of Oregon Soils.....John Ransom Howard
The Pocket Gopher.....Guy Erwin Moore
English Literature Prior to the Time of Chaucer.....Claiborne Lockley Shepard
Representative Writers of the Victorian Age.....Cecil Vivian Staats
Apple Culture.....William Hale Wicks

PHARMACY.

An Investigation of a Special Phase of the Friedel-Croft Reaction....Clarence Warner Beaver
Deterioration of Drugs and Preparations Caused by Micro-Organisms. John William Buster
Yeasts and Ferments.....Edna Blanche Hershner, Alyce Leena Rusk
Bacteriological Analysis of Water.....Alva Otis Horton
A Bacteriological Examination of Milk.....Teroah Winfield Scott, John Thomas Witty

MECHANICAL ENGINEERING.

Mechanical Efficiency of the Steam Engine in the Power House of the Oregon Agricultural College.....Horace Carpenter Brodie, Percy Alfred Cupper
Water Supply System for the Oregon Agricultural College.....David Hirstel

ELECTRICAL ENGINEERING.

Construction of an Alternating Current Motor.....Meigs William Bartmess
The Design and Construction of an Alternating Current Transformer.....Albert Sidney Hall, Ernst Hinrichs
A Proposed Course in Wood Work for the Oregon Agricultural College Elmer Polic Jackson
The Cooper-Hewitt Vapor Lamp and Converter.....Jackson Carle Rinehart

MINING ENGINEERING.

Reduction of Copper in the Wet Way.....Thomas Willard Espy
A Geological Study of the Bohemia Mining District.....Chester Lloyd Proebstel, Albert Sidney Wells

LITERARY COMMERCE.

Propagation of Hothouse Plants.....Etta Belle Carter, Juanita Rosendorf

WANTS.

During a session of the legislature a member of the assembly asked a regent, "When will the Agricultural College cease asking aid of the state?" The regent emphatically replied, "Never, NEVER, NEVER." If a president of the College should be asked when he would cease importuning the Board for more improvements he ought to be pardoned for making the same reply.

Our Museum is in an unfinished condition and specimens are subject to injury. The cost of properly furnishing the room, supplying it with cases and tables, is estimated at not less than $1000. Putting the proposed new library room in good condition and supplying shelves would probably require $350.

While we take great pride in our chemical laboratories, having, perhaps, the finest on the coast, yet some of the rooms are incom-

plete. The chemist in his report itemizes the improvement needed. They would cost seven or eight hundred dollars. I hope there are funds to meet these expenses and that the Board will order the improvements made.

I have on file subject to inspection of the Regents reports from all the instructors, giving in tabular form a full account of the work performed by each during the year.

Reports of the Director, Agriculturist, Chemist, Mineralogist, Bacteriologist, Florist and members of the Station staff are herewith submitted.

Respectfully,

THOS. M. GATCH, President,

Oregon Agricultural College and Experiment Station.

July 20, 1904.

STATE AGRICULTURAL COLLEGE OF OREGON

CORVALLIS, OREGON, June 30, 1904.

Report of the President of said institution to the Secretary of the Interior and the Secretary of Agriculture, as required by act of Congress of August 30, 1890, in aid of Colleges of Agriculture and Mechanic Arts.

I. Condition and Progress of the Institution for the year ended June 30, 1904, especially—

(1) Changes in course or methods of instruction if of sufficient importance to warrant mention, and (2) purpose, structural character, and cost of new buildings or addition to buildings.

(1). No material changes have been made in the Course of Study.

(2). No additions to buildings.

II. Value of Additions to Equipment during the year ended June 30, 1904.

(a) Permanent endowment	$
(b) Buildings	
(c) Library	821.56
(d) Apparatus	6,000.00
(e) Machinery	2,487.40
(f) Live stock	575.00
(g) Miscellaneous	682.94
Total	$10,566.90

III. Receipts for and during the year ended June 30, 1904.

Balance on hand, July, 1903		$ 5,283.96
	(b) Appropriation for current expenses	6,159.05
	(c) Appropriation for building or for other special purposes	18,956.14
2. Federal aid.	(a) Income from land grant, act of July 2, 1862	10,943.36
	(c) Additional endowment, act of August 30, 1890	25,000.00
4. Fees and all other sources.	(b) Incidental fees	783.90
	(c) Miscellaneous receipts, farm, etc.	2,294.19
5. Total		$69,430.60
6. Federal appropriation for experiment station, act of March 2, 1887		15,000.00

IV. Property, year ended June 30, 1904.

Value of all buildings, $160,000; of apparatus, $4,000; of machinery, $20,000; Total number of acres in farm and grounds, 203.63; acres under cultivation, 110; acres used for experiments, 50; value of farm and grounds, $31,000; number of acres of land allotted to State under act of July 2, 1862, 90,000; Number of bound volumes in library, June 30, 1904, 3,600.

Amount of land-grant fund of July 2, 1862, $169,452.09.

V. Students during the year ended June 30, 1904.

	MALES.	FEMALES
1. College of Agriculture and Mechanic Arts:		
(a) Preparatory classes or schools	69	16
(b) Collegiate classes	284	158
(c) Post-graduate courses	1	2
Total, counting none twice	354	176

2. Number of college students in regular four year courses of study in agriculture, 59; mechanical engineering, 88; electrical engineering, 18; mining engineering, 24; household economy, 60; pharmacy, 47.
3. Number of students in short or special courses in agriculture, 10.
4. Number of students in course of study in veterinary medicine, in pharmacy, 47.
5. Number of students in military drill, 354.
6. How many students graduated from undergraduate college courses during the year ended June 30, 1904: Men, 23; women, 12.
7. Average age of students graduated from undergraduate college courses during year ended June 30, 1904: 20.
8. What degrees and how many of each kind were conferred during year ended June 30, 1904: On men, Agriculture, 8; Mechanical Engineering, 3; Electrical Engineering, 4; Mining, 3; Pharmacy, 5.
   On women, Household Economy, 8; Literary Commerce, 2; Pharmacy, 2.
9. What and how many honorary degrees were conferred during year ended June 30, 1904? None.

THOS. M. GATCH, President.

CHEMISTRY.

President Thos. M. Gatch:

DEAR SIR:—I have the honor to present herewith a brief summary of the year's College work in chemistry.

During the year Professor John Fulton has had charge of the classroom and lecture work in general chemistry, also the classroom and laboratory work in mineralogy, geology, assaying and metallurgy.

Mr. C. M. McKellips has had entire charge of the pharmaceutical laboratories and also classroom and lecture work in all the purely pharmaceutical subjects.

Mr. H. D. Gibbs has had charge of the laboratory in general chemistry, also entire charge of class and laboratory work in analytical chemistry. Mr. Gibbs also had charge of both lecture and laboratory work in agricultural and organic chemistry.

During the past year Mr. F. E. Edwards has been absent and has spent the year in advanced study in chemistry at the University of California.

The work of the year progressed favorably considering the obstaeles to be contended with.

At the present time all of the work in chemistry has been moved into its quarters in Agricultural Hall. The quantitative laboratory during the past year was located in the Administration building

This has recently been moved into the new quantitative laboratory which is as yet unfinished.

Several matters of very great importance should be attended to as soon as possible so that students will not have to lose time waiting for the laboratories to be finished after school opens.

The items of most importance are as follows:

1. The new quantitative laboratory in Agricultural Hall should be finished. This room needs hoods and cases for apparatus.

2. The balance room which joins the quantitative laboratory should have covered shelves for the balances; also cases for chemical books and a table.

3. The northwest recitation room on the third floor should have a demonstration table with gas and water, also small hood.

4. The southwest room on third floor is vacant and this seems to be the only available place for experimental work in soil physics and agricultural chemistry. The study of these subjects requires tables, gas, water and hood. I would suggest that this room be fitted for this work.

5. Another matter of vital importance in chemical work is the question of distilled water. A distilling apparatus and reservoir adequate for all our needs would cost probably $100.

6. Mr. McKellips is very much cramped in his present quarters. If the pharmacy department is to be continued, its needs should be considered, and, if possible give the department a little more room.

During the College year Professor Fulton, Mr. McKellips and Mr. Gibbs devoted all of their time to College work. During the summer vacation Professor Fulton spent several weeks in the Experiment Station laboratory helping the Station chemist with the analytical work. Mr. McKellips also spent about two months in the Experiment Station laboratory. During the College year the Station chemist devoted approximately one-third of his time to College work and two-thirds to Experiment Station work.

The foregoing very brief report is respectfully submitted.

A. L. Knisely, Chemist.

MINERALOGY AND GEOLOGY.

President Thos. M. Gatch,

I herewith submit a report of the work done in the department of mineralogy and geology during 1903 and 1904.

There were 12 students in geology during the fall term, five hours per week. The class consisted of Junior mining students and Senior agriculturals.

Four Seniors took advanced mining geology for which, by vote of the faculty, a subject in mechanics was omitted. This consisted of lectures and were practically such as were received by me from Prof. Smyth of Harvard. Five hours per week. Throughout the entire year three Seniors and one special were given instruction in mineralogy and was substantially the course offered the mining students of Harvard. This required seven hours per week.

During the winter and spring terms three Seniors received instruction in assaying and metallurgy, requiring twelve hours per week. A course in elementary geology is to be offered to the Senior students in agriculture beginning at opening of school. I have found it necessary to make room to accommodate them. In winter the lecture room is very dark; it should be painted some color other than the present dark red one.

Within a year the price of gasoline has increased one half. We could meet this by erecting a coal furnace. I have made a rough estimate on the painting and furnace. The former will require about $65 and the latter about $50. If these amounts can be spared for this department I am certain that the efficiency will be increased a like sum.

Respectfully submitted,

JOHN FULTON, Instructor.

BACTERIOLOGY.

President Thos. M. Gatch,

DEAR SIR:—I herewith submit a report of class work done in my department during the past year.

The class in bacteriology has been taught the underlying principles of this important modern science, and the knowledge they have gained through lectures, and the laboratory experiments which they have carried out, will be of great benefit both to them and the community in which they live.

The bacterial diseases of human beings, stock and poultry were carefully studied. Disinfectants, their use and comparative values, were thoroughly tested upon cultures of disease producing organisms, in order to find the minimum amount of each disinfectant necessary to destroy the germs.

The bacterial analyses of water and milk, both quantitative and qualitative together with the classification of the organisms found, formed part of the students required duties. Seven students wrote their graduation theses on this subject. The students in the farmers' and dairy short courses, received a series of lectures and laboratory demonstrations along the lines of bacteria in their relation to agriculture and dairying, the subject was very instructive and interesting to them.

I have endeavored to properly discharge my duties on committee and such other work as was required of me in connection with the institution.

Respectfully submitted,

E. F. Pernot.

FLORIST AND GARDENER.

Presedent Thos. M. Gatch:

Dear Sir:—I have the honor to transmit the following report on the work done for the past year, beginning July 1, 1903, and ending June 30, 1904.

On July 1st the work of constructing a system of new walks and roads about the Agricultural Hall was begun. The manner of construction proceeded as follows: The roadbed was excavated to a depth of twelve inches and the earth used in leveling the surface of the lawn adjacent to the said roads and walks. After the removal of the earth from the roadbed a four-inch tile drain was laid on either side and was covered with coarse gravel instead of earth to insure a better drainage to the surface of the road. The width of each road is from fifteen to twenty feet and has a length of 260 yards. The gravel for the said road was obtained on the river bar and was placed ten inches in depth in the roadbed with one load of earth to four loads of gravel to secure perfect stability, the former being well incorporated with the gravel before being placed in position.

A walk was constructed from the northwest corner of the Agricultural Hall to join a similar one extending from the Administration building to the armory. The former walk was excavated and the earth used in leveling and toning up the adjacent lawn. This walk has a central drainage system which has its outlet in the drain that serves about the Agricultural Hall. After placing the drain, coarse gravel was then laid over it and the walk-bed filled with

gravel and earth in the proportion of four loads of gravel to one of earth. The depth of this material is ten inches. The gravel and earth were thoroughly mixed in the walk-bed and packed securely by a hand-roller. After the foundation of the walk was well established, a top dressing of pulverized granite was placed on the surface two inches deep. This also was well packed by a roller. The length of the walk is 48 yards and the width 3 yards, making an area of 144 square yards.

A walk similar to the former one was made from the Administration building to the back entrance of the armory. This walk was constructed the same as the first, with the same kind of material. The length is 130 yards and the the breadth is 2½ yards.

A walk was constructed from the public road west of the Administration building to the road west of Alpha Hall. After removing the old board walk, the new one was made as follows: The earth was removed to a depth of ten inches. A double drain was then placed in three-fourths of it. This drainage system has a lateral opening which connects with the sewer near the blacksmith shop. The foundation of dirt and gravel having been completed a surface dressing of granite was placed two inches deep. The utility of the walk was then secured by packing it securely by a hand roller. The dirt removed from this walk was used in building up the adjoining lawn. The gravel was secured from the river bar. This walk is 239 yards long and 2⅓ yards wide making an area of 557⅔ square yards. The old gravel under the board walk was utilized in making the new walk.

A cement walk was constructed from the Administration building to the public road west of the same building. The earth in this walk was removed to a depth of six inches and used in filling holes in the campus. A composition of gravel and lime was then placed in the bottom of the walk and the same thoroughly mixed and stamped. After exceedingly firmness was secured in this mixture a top layer of cement was then placed and properly finished. This walk is 55 yards long and 2 yards wide.

The campus has been kept in shape in respect to mowing, planting new trees and working the various mounds and flower beds thereon. The filling and leveling of the campus has received immediate attention and much has been accomplished along this line. The various beds along the border of the campus have been planted and attended to properly. The numerous lawns about the Admin-

istration building, Agricultural Hall, Mechanical Hall, Alpha Hall and Armory have been kept mowed and watered where sufficient water could be obtained. The numerous flower beds on the lawn were fertilized and spaded as soon as the weather permitted. They were then designed and planted with appropriate plants. The flower beds have been attended to in respect to hoeing, watering and trimming. The walks and drives of the place have been trimmed and an unceasing attack on weeds therein has been carried on.

One hundred pounds of grass seed (*Agrostis stolonifera*) was sown on the lawn in order to secure a desirable lawn, and eradicate foreign weeds. This grass, being a rapid grower, will strive to overpower the weeds in their struggle for existence.

On all favorable opportunities during the winter the work of digding borders and planting the following shrubs was accomplished. Shrubs were taken from overcrowded localities and planted in more desirable places.

By the kindness of the grounds committee, one hundred dollars were appropriated for the purpose of purchasing trees and shrubs. This lot consisted of the following: Araucaria imbricata, Holly, box, Magnolia grandiflora, Pinus ponderosa, Irish juniper, Sweedish juniper, Lawson cypress, White birch, European mountain ash, Sugar maple, Cork elm, Laurustinus, English juniper, Chinese juniper, Arborvitæ pyramidalis, Carolina poplar, Sycamore, Norway maple, Prunus pissardi, Cut leaf weeping birch, Kilmarnock weeping willow, Camperdown weeping elm, Weeping mountain ash, White thorn, Pink thorn, Paul's scarlet thorn, White lilac, Purple lilac, Laburnum, Snowball, Deutzia, Large flowering clematis, Clematis panculata, Gooseberies (Champion), Pomomia currants, Himalaya giant blackberry.

In addition to the above the following plants have been propagated and planted out on the campus and in the various borders: Achyranthes, one hundred and fifty; alternanthera, seven hundred; agratum, three hundred; lobelia, three hundred; echeveria glauca, two hundred; pryrethium, seven hundred and fifty; verbena, five hundred and fifty; geraniums, seven hundred and fifty; stocks and astors, two hundred; also one hundred and fifty dahlias, one hundred and fifty cannas, one hundred and fifty hollyhock, two hundred La France roses, and one hundred pansies.

The work has been promoted at all times as fast as the weather would admit. As you are aware, I have charge of the experiment

orchard which has taken much of my time but I am pleased to say that the work in both departments has been prosecuted with good results. The work on the campus has reached such a stage that everything that is done gives the grounds a finished appearance.

During the month of August last the roof of each house was given two coats of paint on the outside and reputtied. This was needful on account of the bad leaks in the roof. The work was done by our own men. The north greenhouse, as we term it, received a complete new staging as the old one had become quite useless on account of its decayed condition. The material used for this purpose was discarded lumber that was saved from the various main buildings. Also the cold frame lights received a good overhauling by reglazing and two coats of paint. The work was done during bad weather when the men could not do anything outside.

The second week in September last, I was given charge of the exhibit at the state fair which occupied one week of my time but reached home in time to take charge of the class in floriculture.

In order that the students may be instructed more fully in the management and the growing of early vegetables, the department is in great need of more cold frames to be used for the purpose of forwarding vegetable plants of all description. The old window sashes loaned to the College by the writer years ago for covering plants have become so out of repair that it is impossible to use them any longer. A dozen lights, five feet long and three feet six inches wide need not cost much, only for the glass as the wood work may be made in the carpenter shop and the glazing might be done by our own help in bad weather. Also, owing to the very bad condition of the green houses and the staging of the same, a thorough overhauling is needed in order that they may be enabled to withstand the storms of the coming winter. The foundation is gradually sinking and the whole structure is fast decaying. In order that they may be made more solid a four inch brick wall with an eight inch pier on the inside at every eight feet should be constructed. If this were done and new cells and bottom sash rails put in the houses might last some considerable time yet.

Very respectfully submitted,

George Coote.

LIBRARIAN'S REPORT.

President Thos. M. Gatch:

Dear Sir:—There have been added, by purchase, to the library of the Oregon Agricultural College during the year, 376 volumes of books, and there have been received into it of government and other publications 250 volumes. The purchased volumes which have added very largely to the value of the library, comprehend a wide range of subjects with history, biography and compendiums of oratory and choice literature predominating. These have all been labeled and recorded and arranged by author, and also by subject in the card index and placed in convenient position for use.

For the benefit of students and all connected with the school there have been taken by college subscription about 40 monthly and 25 weekly publications. Many weeklies, also, mostly of farm interest come regularly into the library free. The total cost of all books, magazines and papers has been for the year $821.56.

According to the report of the librarian for the year 1898 and 1899 an average of six books daily was taken out of the library. During the past year, 1903-4 the average number of books daily drawn has been about 25 which, considering the attendance of the two years shows a large increase of interest in and appreciation of the library.

Much pains has been taken during the year just closed to familiarize students with the use of reference books, also with authors and their works and all of the other literature of the library. The repositories for filing and shelf room for books ought to be largely increased for the coming year. Proper filing and classification are difficult without much more room than is used.

Respectfully,

R. J. Nichols, Librarian.

REPORT OF THE DIRECTOR.

President Thomas M. Gatch:

DEAR SIR:—I wish to submit the report of the Station department of agriculture, together with the reports of the Chemist, Entomologist, Bacteriologist and Floriculturist for the year ending June 30, 1904.

The reports of the respective departments of the Station indicate that much work of economic value to the agricultural and other industrial interests of the State has been accomplished. This work could not have been attained were it not for the united efforts of the departments represented in this report. It will also be noticed that co-operative work has been undertaken with some of the horticulturists and agriculturists of this State. This assistance from the outside growers made possible the solving of certain problems which were impossible to solve by the Station alone because of insufficient funds.

At the present time the Station is in great need of more funds to investigate the problems with which it is constantly confronted. The immense field of horticulture has scarcely been touched and it is plainly the duty of this Station to give earnest and enthusiastic support to the development of this great industry.

It is thought that the present rapid system of curing hops at high temperature is causing large losses of lupulin through volatilization. Hence experimental work in the curing of hops may evolve methods that would be of economic value to the hop-growing industry.

Agriculture is rapidly expanding in our State and calls the attention of the Station staff to its new phases. The growth of our urban population with its demand for poultry and eggs has presented a new interest along lines of economical production of poultry. Dairying and other branches of animal husbandry are asking for assistance. Many other important industries of our State can claim the attention of the Station workers, thus presenting in the aggregate a large field for scientific research.

The Station is certainly growing in the estimation of the farmers, judging from the increase in the correspondence of the respective departments. As for example, the department of agriculture for the year 1900, only received 591 letters from farmers asking for in-

formation, while the past year 1411 communications have been received.

In addition to the demands on the time of the Station worker in answering correspondents, there is a growing want among farmers and orchardists for the Station to conduct more farmers' institutes, and to assist in agricultural and horticultural conventions. The value of these institutes to communities in which they are held is shown by the improved methods of husbandry which usually follow.

During the past year 14 such institutes, having an aggregate attendance of about 5,000 people were conducted by the Station staff. The means for maintaining these meetings were supplied by the Station which, according to the interpretation of the National Director of Experiment Stations, is not the proper use of these funds.

GENERAL AGRICULTURE.

The major work of this class has been directed along lines of rotation in cropping. A large portion of the College farm is devoted to this work. Indications at present are quite favorable toward the common vetch, *Vicia sativa*, as being a desirable crop to rotate with spring sown cereals. This plant seems to produce a favorable physical change in the soil as well as supplying ample available nitrogen for maximum cereal crops. This season, although an abnormally dry one, with only 2.05 inches of precipitation since the 15th of Abril to the time of harvesting the crop, July 10th; we secured an average of 2.81 tons per acre. This crop was sown on oat stubble in November. The land was simply disced and one bushel each of vetch and winter wheat was drilled in per acre. This crop was pastured with sheep up to May 4th.

Rotation systems with clover and corn in connection with wheat are also continued. Various cultural methods for cereals have been practiced during the past season and we hope to test the value of subsoiling next season.

The special systems of rotation on the four one-acre plats have been continued in co-operation with the chemical department.

FORAGE PLANTS.

In this branch an effort has been made for the past four years to introduce alfalfa into Western Oregon. It has been conclusively demonstrated at this Station that alfalfa can be successfully grown

in this section. Last season, on a third year crop, we secured four cuttings, aggregating 18.28 tons of green forage per acre, and a fair fifth crop was depastured by sheep. This year the alfalfa looked quite promising the early part of the season, but owing to the drought we shall perhaps only secure three crops for cutting and possibly a good pasture crop in the fall.

The effects of discing alfalfa was given a trial last April. Two acres of four-year old alfalfa were selected for this work, one and one-half acres of this were thoroughly disced and harrowed three times. The one and one-half acres yielded at the first cutting 1.16 tons cured hay and 4.56 tons of green forage. The undisced half-acre yielded 2.44 tons of green forage while the disced half-acre yielded 4.71 thus making approximately 93 per cent in favor of discing. The abnormally dry season was evidently favorable to the discing.

Four co-operative experiments were undertaken on different soils with alfalfa in Western Oregon last season and about one ton of inoculated soil was furnished to farmers.

There were 345 packages of seed comprising mainly forage plants and cereals, sent out last season. These were sent to growers who desired to grow crops for exhibition purposes and to those who wished to make tests as to the value of certain cereals and forage plants in their respective localities.

ANIMAL HUSBANDRY.

The principal work in this branch has been along the line of feeding dairy cows and the fattening of swine. The results obtained for several years in the experimental feeding of swine are recorded in Bulletin No. 80, except a more recent experiment of feed-wheat versus wheat and dried blood.

Twelve hogs were divided into two lots and were fed 50 days. Lot 1 consumed 2451 pounds of wheat chop and gained 460 pounds in live weight, thus making one pound gain in live weight for 5.24 pounds of chop consumed. Lot 2 consumed 2289 pounds of wheat chop and 345 pounds of dried blood. This lot made a gain of 465 pounds live weight, making a gain of one pound live weight for 4.92 pounds of chop and .74 pounds of dried blood. It will be noted that the dried blood as a supplementary feed with wheat was fed at a financial loss.

The feeding experiments with dairy cows consisted mainly of

soiling and testing the relative value of ground oats as compared with bran for feeding dairy cows:

A test was also made to determine if a cow could be kept in good condition on silage.

Excellent results were secured from soiling last year. With this system 4½ acres of land furnished the rough forage for 17 head of cattle and 25 hogs from May 13 to September 1st. The system this season will not yield such good results.

The feeding test of bran versus oat chop was continued for ten weeks but the results are not yet tabulated.

The silage test was made on a non-breeding Jersey cow which freshened in February, 1902. In January, 1904, this cow was fed largely on silage, with a moderate amount of mill feed and light ration of hay as a preliminary preparation. From January 1st to April 30th, she was fed wholly on corn silage and a light ration of ground oats daily. She consumed during the 90 days feeding 3785 pounds of corn silage and 270 pounds of the oat chop. The following table shows variation in weight and her production:

	Weight-Lbs.	Lbs. Milk.	Av. Test.	Lbs. Fat.
December 1	955	196	5.8%	11.36
January 1	945	199	5.9	11.74
February 1	905	178	5.7	10.15
March 1	925	195	5.8	11.31
April 1	890	251	5.5	12.15
April 30	860	221	...	...

The cow was in good condition at the close of the experiment which indicates that silage may with safety constitute a large portion of the ration of a dairy cow.

This experiment was undertaken at the suggestion of the Government Agrostologist to determine in a measure if it were practicable to winter cattle in Alaska on grass silage.

The three pounds of ground oats were fed daily for the purpose of bringing the corn silage up to a protein standard, equaling that of mixed-grass silage.

Protein percentage of feed consumed:

Ground oats 11.56
Corn Silage 1.58

Protein percentage of grass silage (approximately) 2.72.

Average amount of total protein consumed daily in 42 pounds of corn silage and 3 pounds of ground oats 1.01 pounds. Approxi-

mate amounts of protein contained in 40 pounds of grass silage 1.08 pounds. Thus it will be seen that this test indicates that cattle can be successfully wintered on grass silage, and that dairy cows may be expected to yield a reasonable amount of milk when fed exclusively on this feed.

MISCELLANEOUS WORK.

Among the most important of this class of work during the past year were silage investigations. Steamed and unsteamed corn silage have been tested and whole and uncut vetch. The steamed silage contained much less acid than the unsteamed, and the additional cost of steaming is more than repaid in the improved quality of the silage.

It was found that whole clover or vetch silage was more expeditiously handled than the cut silage, although it required a larger silo space per a given weight.

Co-operative work with the department of chemistry has been undertaken this season in the selecting of vetch with a high protein content.

Preliminary work has been commenced for the improvement of barley for malting purposes. It is thought that a high protein content is desirable in a malting barley, hence the Station has made a comparative test of six varities during the past year-with the following result:

Protein in Barley.

Lot No.	Name.	Moisture.	Dry Matter.	Protein in	
				Dry Material.	Original Sample.
			100° C.		
2666	Hulless	7.65	92.35	13.76	12.71
2667	Highland Chief	8.35	91.65	13.47	12.34
2668	Swanskolekow	7.15	92.85	14.89	13.82
2669	Chevalier	8.19	91.81	13.52	12.41
2670	Webb's Burton Malting	8.72	91.28	14.42	13.16
2671	Mansbury	8.38	91.62	13.89	12.73

The work at Moro has been discontinued. Results show that the common field pea and alfalfa can be successfully grown in the wheat belt of this section without irrigation.

Four bulletins have been issued during the year, viz: No. 77, "A Continuation of Bulletin No. 74 on Onions, Also Notes on Strawberries and Varieties of Vegetables;" No. 78, "Canning Cheese;"

No. 79, "Plant-food and Use of Fertilizers;" No. 80, "Some Results in Swine Feeding."

Received from sale of farm produce, livestock and the dairy, $1,622.07.

Respectfully submitted,

JAMES WITHYCOMBE.

DEPARTMENT OF CHEMISTRY.

I have the honor to submit herewith a brief synopsis of the work of the Chemical Department of the Experiment Station for the year ending June 30, 1904.

The work of the year has been in many ways similar to that of the preceding year, in fact many of the lines of investigation will extend over several years. The subjects under investigation by the chemical department at the present time, some of which are being studied together with other departments, are as follows:

1. A study in crop rotations and their effects upon the soil.
2. The effects of summer fallow are being studied.
3. The conservation of moisture in the soil. This work is located at Moro, Oregon, and is just being completed.
4. A study of hops.
5. The availability of plant food in the soil.
6. Acid soils in Oregon.
7. Studies in fruit and vegetable drying.
8. The effects of fertilizers on prune trees.
9. The amounts of plant food—especially potash—in old apple orchard soils.
10. The use of lime in the straw heap; does it hasten or retard the decomposition of the straw?
11. A study of protein in vetch hay.
12. A study of the physical condition of certain soils.
13. An investigation is under way to ascertain the fertilizing value and amounts of by-products, refuse or waste, which accumulates at the various canneries and packing establishments in the state.
14. Miscellaneous work. This consists largely of the examination or analysis of materials pertaining to agriculture, such as soils and farm products. A few examinations of well waters and mineral waters were made, also the analyses of several insecticides. In one case considerable time was spent in analyzing samples of cocoanut oil for the Assistant U. S. Attorney of Portland.
15. A study is being planned of the action of lime and potash salts upon the Willamette Valley soil.

Institute work consumed several weeks during the year.

During the past year the chemist's work was very much interrupted owing to the unfinished condition of the laboratories and to College work. The chemist devoted from one-fourth to one-third of his time to College duties.

During the summer of 1903 Mr. C. M. McKellips assisted the Station chemical department for two months. Prof. John Fulton also assisted in Station work for several weeks. During the College year the Station chemist had no assistance whatever until toward the end of the year when one of the Junior College students devoted three to four hours of his time daily to routine chemical work for the Experiment Station. Since the last of May Mr. F. E. Edwards has been assisting in the chemical department.

In order to execute the chemical work and investigations of the chemical department of the Experiment Station with any degree of satisfaction it is necessary that the chemist be able to devote his whole time to Experiment Station work or else have an assistant who shall devote all of his time to chemical work in the Experiment Station laboratory.

The chemical work was interrupted for a time during the fall of 1903 when the department was moved into its new quarters in Agricultural Hall. At the present time the chemical department is very pleasantly located in its new laboratories and is prepared for any agricultural chemical work.

The foregoing brief synopsis is respectfully submitted.

A. L. Knisely, Chemist.

DEPARTMENT OF BACTERIOLOGY.

I herewith submit a condensed report of work done in my department during the year ending June 30, 1904.

My major work has been the continuation of an experiment in curing cheese in hermetically sealed cans. The results obtained up to the first of this year in curing the curd in tin cans of sizes varying from one to twenty-three pounds were all that could be desired and bulletin No. 78 was issued setting forth the process in detail. However, it occurred to me that possibly the cheese might be ripened in the same manner and avoid the expense of a can for each cheese. In order to obviate this, a box was constructed of galvanized iron and provided with eight tin circles of sufficient size to contain a cheese of about six pounds each. The four lower ones were soldered to the bottom of the box and the four upper ones to a sheet of tin which fitted loosely inside of the box forming a partition. The edge of the box was provided with a V shaped flange which formed a gutter around the outside, about one-half inch deep, one-half inch

wide and one-half inch below the upper edge of the the box. The cover was made to fit the box, and its flange extended to the bottom of the gutter. Two wire clamps similar to those on bird cages were fastened to the side of the box for the purpose of holding the cover in place.

Before using the box it was thoroughly scrubbed with hot water and soda. When dry, it was heated and coated with a thin film of parraffin to protect the tin and iron from the action of the salt in the cheese.

A box of this character may be repeatedly used for years with moderate care and it may be made of any size and with circles to suit the form of cheese to be cured.

Some difficulty was experienced by the formation of gas at first, but this was easily overcome by placing a small valve in the cover, which was so constructed as to allow the gas to escape but no air to return into the box.

After the cheese was made in the ordinary manner, it was taken from the press with the bandages on and slipped into the circles of the box, the cover was then placed in position, clamped down and the gutter filled with hot canning wax, thus hermetically sealing eight cheeses of about six pounds each. The box was then placed in a temperature of about 60°F where it required no further attention.

After six weeks curing, the cheeses were taken out and weighed; it was found that no loss of weight had occurred during that time. Two check cheeses from the same lot, cured on the shelf in the curing room, had lost eleven per cent. in weight. When the cheese was taken out it was as bright and fresh as when placed in the box. The circles in the box are for the purpose of holding the cheese in shape.

This box represents a miniature curing room in which cheese may be ripened and stored without loss of weight by evaporation. The loss by mould in warm, moist districts is obviated, and considerable expense is saved by the cheese not requiring attention while curing. A cheese may be removed from the box at any time without injuring those which remain.

The question has been raised as to cheese cured in this way containing too much water, but that is by no means a detriment to it, as the small amount of water is thoroughly incorporated with the

casein and is probably instrumental in bringing about the predigested condition which characterizes it.

The strongest and most important feature of cheese cured in this manner is its digestibility. Many tests have been made by individuals with weak digestive powers who found that they could eat an abnormal amount of this cheese without ill effects. This will probably solve the problem of a nutritous food for individuals suffering from diatetic troubles, and it will also increase the general demand for cheese as an article of diet.

Another advantage is that the flavor of the cheese may readily be controlled by the use of pure cultures of organisms whose ptomains act as enzymes and not only control the flavor, but appear to have a peptonizing action which predigests it. The advantage of being able to maintain a standard flavor in cheddar cheese is obvious.

During the dairy short course I introduced a simple and practical method of perpetuating pure cultures of organisms for "butter starters."

The apparatus consisted of common one-pint milk bottles plugged with cotton batting. The bottles, after being filled two-thirds full with fresh skimmed milk from the separator, were placed in a long wooden box provided with a tight fitting cover. A thermometer was placed through the cover into a bottle filled with water in order to indicate the temperature of the contents of the bottle. The bottom of the box was provided with a hole into which the steam pipe, used for scalding cans, was inserted; the steam was then turned on, raising the temperature to 160°F, and thus maintained for ten minutes. This operation was repeated three different days, after which the milk and bottles were thoroughly sterilized and remained so.

One bottle, of the twelve first placed in the box, contained a glass tube which passed through the center of the cotton plug, the lower end was slightly closed, while the upper end was plugged loosely with cotton and inserted in a medicine dropper rubber bulb. After the milk was sterilized this bottle was inoculated with a culture of the germs desired, where they were allowed to grow for twenty-four hours or more. When cream was ready for inoculation, the cotton plug, together with the pipette, was withdrawn from the inoculated bottle, and transferred to another bottle of sterile milk, thus inoculating a fresh supply for the next churning. The contents of the

first bottle was then emptied into the cream which was allowed to stand until the required acidity was obtained.

The only precaution necessary is to transfer the loaded pipette quickly from bottle to bottle and avoid touching it with anything during the operation. This method is very simple and quite within the reach of any one. The students handled it easily and kept their cultures pure. A sufficient number of bottles of milk may be prepared to last one month or more as it will keep sterile for a long time. Some of the milk unused by the dairy students six months ago is still as fresh as ever.

The cultures with which to inoculate the first bottle may be obtained in the market, or from experiment stations which prepare them for that purpose. To inoculate the first time, withdraw the cork from the culture bottle, pass the neck through the flame of an alcohol lamp several times to sterilize it, then remove the cotton plug and pipette from the sterile milk bottles just high enough to pour a portion of the culture into the milk, replace the cotton plug as quickly as possible and avoid touching anything which might come in contact with either the milk or culture. If any culture remains in the original bottle it will be unfit to use for another inoculation later on.

From specimens received at the laboratory during the past year entero-hepatitis among turkeys was found to be the cause of quite a serious loss of fowls. In another district there was quite a heavy loss of turkeys from pneumonia which appeared to be of an infectious type. Another specimen of special interest received was the intestine from a hen; the outer wall of the intestine was covered with nodules resembling tubercles. Upon dissection they were found to contain the air sac mite (Cytodites nudus) in various stages of development.

One of the clam canning establishments on the coast forwarded a sample of clams with the complaint that a portion of their season's run had spoiled by souring. An examination of the material showed quite a number of spore-bearing organisms, somewhat resembling bacillus mesentericus vulgatus. The temperature which they were using for canning was not sufficiently high nor continued long enough to destroy the vitality of the spores. These germinated into the vegetative cells which acted upon the material and aused the souring when the cans were submitted to a warm tem-

perature for some time. The difficulty has been remedied by properly controlling the temperature at the time of canning.

At the present time experiments in canning vegetables and fruit are in progress. Some asparagus which had been canned for nearly one month and kept in a warm temperature was opened and found to be equal to the fresh article.

The canning is done with a low temperature which does not alter the flavor or structure of the material.

Respectfully submitted,

E. F. Pernot.

DEPARTMENT OF FLORICULTURE AND OLERICULTURE.

I have the honor to report the work done in the orchard and garden during the past year, commencing July 1, 1903 to July 1, 1904.

The work in the orchard has been done in regard to neatness and care of the numerous varieties of fruits. All varieties of fruits received careful attention and notes were taken on the same. All varieties that were obtainable at that time were taken to the Oregon State Fair. A report on the orchard has been made to the department at Washington as cooperative work.

In addition to the above notes have been taken on all the varieties in regard to date of blooming, size of crop, date of formation of buds, opening of leaf buds, keeping qualities of fruit, date fit for use, and true value as a variety. Also many varieties have been grafted, and am pleased to say all are in a prosperous condition. These new grafted varieties add greatly to the already large list of varieties growing in the orchard.

The scientific pruning of all the trees has been performed at suitable seasons. More pruning has been needed in the last year than usual, owing to a sudden change in climatic conditions prior to April 1st. From this cause many pear and apple trees have died back and many of the former have died entirely. These dead trees have been uprooted and burned in order to prevent the spread of any germs or insects.

The vineyard has been properly taken care of and notes taken on the same. Several varieties have proven very satisfactory for valley growing.

The small fruits have been cultivated, pruned and notes taken on

the same. The results from many of the small fruits are very satisfactory.

Cabbage seed of the Early Winningstadt variety was sown last August. This seed was saved by the home Station and proved to be very satisfactory. Every plant came true to variety. Notes were taken on the same in regard to size of head, average weight, yield, adaptability to locality, etc. This variety matured June 1st.

Forty-one untried varieties of cabbage have been sown this spring and notes are being kept on same, also five varieties of cauliflower. This seed was donated by Mr. Francis Brill, Long Island, N. Y. The seed was sown in shallow boxes on March 3d. After growing in the greenhouse until April 18th they were set out in the open ground west of the fruit dryer. These plants consist of early, medium early and late varieties. They have all received the same kind of cultivation. By testing in this way we are able to ascertain the varieties which are best adapted to our conditions. Also the best varieties in regard to date of maturity, size of heads, etc.

The cutworm, which is our most dreaded enemy of the cabbage, succeeded in destroying several plants at first but it has been subdued.

About one hundred tomato plants have been set out in the experiment garden. These plants also will receive the same treatment as the other vegetables.

In regard to hops, I am sorry to report that they are almost a total failure. They have received the best of care and cultivation but do not seem to respond. Some varieties have done better than others; among these can be mentioned Numbers 5593, 5587, 5768, and 5758. The above named varieties reached the top of the poles and half way across to the next one. The remainder of the varieties are from two feet to four feet in height. The soil and climatic conditions seem to be unfavorable.

I would advise the removal of the hops this year to a better location, or use the old as a check for the new yard. The work of the orchard and garden has been done as fast and properly as weather would permit.

Respectfully submitted,

GEORGE COOTE.

DEPARTMENT OF DAIRYING.

I submit herewith report of work in the Dairy section of the Agricultural Department for the fiscal year ending June 30, 1904. This work may be conveniently grouped as follows:

1. Tests of Cream Separators
2. Pure Culture starters in butter and cheese making.
3. Shrinkage in weight of butter and cheese after manufacture.
4. Use of scale pepsin instead of rennet extract in cheese making.
5. Perfection of methods for canning cheese.
6. Weekly fat tests of dairy herd.
7. Authenticated tests of dairy cows for A. J. C. C. Register of Merit.
8. Irrigation Investigations.
9. Farmers' Institutes

1. Eight different makes of cream separators have been in use during some portion of the year, viz., American, Empire, De Laval, Iowa, National, Sharples, Simplex and United States. These machines were all of the hand-power style and of about 450 pounds per hour capacity. Many tests have been made of each machine to determine its thoroughness of separation under carrying conditions. The results of these tests will be published in bulletin form early next year.

2. In the work with pure culture starters, valuable assistance was rendered by Mr. O. Douglass, Boston, Mass., Mr. S. C. Keith, Jr., Cambridge, Mass., and Mr. John Jamison of Philadelphia, each of whom furnished free samples of their preparations. Mr. Douglass was especially active in the matter, furnishing three different butter cultures, and weekly samples of his cheese culture. This work was conducted co-operatively with the Department of Bacteriology.

3. Cheese was made after the usual method, both Flats and Young Americas being produced, the former weighing 25 to 27 pounds and the latter 5 to 7 pounds. The loss in weight during the curing process, about 60 days, ranged from 8 to 13 per cent., the higher percentage losses occurring with the smaller sizes.

Owing to lack of storage room the butter samples tested for shrinkage were held but seven days. Sixteen rolls (32 pounds) were placed in a refrigeration box, but without ice, on five separate occasions. In each case the shrinkage on the entire lot amounted to just eight ounces, or the equivalent of one-fourth ounce per lb.

4. Scale pepsin appeared to give practically the same results as Hansen's rennet extract in the manufacture of cheese. Only a limited number of trials were made however.

5. The methods of canning cheese, also conducted in co-operation with the Department of Bacteriology, differed from those of last year in the use of larger cans, and in pressing the cheese in regular cheese hoops before placing in the cans.

6. Weekly butter fat tests of each cow in the Station herd have been made during the year. These tests, with the daily weights of milk, give valuable information relative to variation in fat content of milk with age of the cow, and advance of the period of lactation; total production for the year, and weekly periods of greatest production, etc.

7. The testing of cows for eligibility to the A. J. C. C. Register of Merit, has been taken up for the W. S. Ladd estate of Portland. This work was begun in March, 1904, and for the month of June eleven cows were under test. The number will increase as the cows freshen in this herd until there will be about thirty under test. Test periods of two full days duration are required each month.

8. Irrigation investigations of a preliminary nature were conducted in Klamath county during the month of July. Information was obtained relative to the history and capacity of the different irrigating plants, the manner of distributing and applying the water; the manner of growing the principal crops and the amounts produced per acre, and the character of the water supply. This work will be continued during the early part of the next fiscal year.

9. Twelve Farmers' Institutes have been attended during the past year, each requiring an average of about two and one-half days' time. In addition to the institutes, the annual meetings of the Oregon Dairymen's Association and the Oregon Irrigation Congress were attended.

Respectfully submitted,

F. L. Kent.

DEPARTMENT OF ENTOMOLOGY AND PLANT DISEASES.

The work of this department has been characterized the past year by more than the usual amount of cooperative field experimentation. This has been made possible not only by the liberal policy which has relieved the entomologist of most of his teaching in the college department but also by the fact that more funds have been available for the work.

New and commodious laboratories in Agricultural Hall give

much better facilities for laboratory investigations, the obsolete spraying outfit has been replaced by a modern power machine operated by a gasoline engine, and the laboratory equipment has been materially increased. The chief need at present is for better library facilities.

The principal lines of work to which attention has been directed the past year may be summarized as follows:

1. APPLE SCAB.

In my last report I called attention to the prevalence of Apple Scab in the orchards of Western Oregon and to the fact that many growers had reported poor results from following the usual directions for spraying for this disease. In fact at the meeting of the State Horticultural Society in January, 1903, the value of the ordinary methods of spraying with Bordeaux for this disease was questioned by some of the growers present and the entomologist was requested to conduct some careful experiments and report results.

I also called attention to the fact that some experiments in controlling this disease were being conducted on a block of 400 Newtown Pippin trees belonging to Mr. John Meeker of Corvallis. This particular block of trees was selected, first, because the Newtown Pippin is one of the varieties most susceptible to apple scab in the Willamette Valley; second, because the orchard has been neglected for years. It is now about fifteen years old, has never been thoroughly cultivated, and has been sprayed but two seasons during one of which it received but one application.

The orchard was sprayed five times the past season, with the 4-4-50 Bordeaux, viz., on April 30, May 14 to 19, June 1 to 3, July 1 to 3, and August 15. The last two applications were made more particularly for the codling moth, only the poison being used. These applications no doubt were of practically no value as a preventive of scab, only the first three being of any benefit. The climatic conditions were particularly favorable to the development of scab. This was particularly true during the time of the second spraying, May 14 to 19, when the showers were almost continuous. Thus the application which should have done more good than any other was made under very adverse circumstances, being made between showers or even when rain was falling.

Near the middle of this block of trees, eleven trees were left unsprayed, and at picking time four trees were selected, two sprayed

and two unsprayed, which stood near together and were as nearly alike as it was possible to select. The fruit from each tree was carefully gathered and divided into three grades. The first, consisted of fruit entirely free from scab; the second, of that which was slightly scabby—that is, fruit that had only one or two slight specks of scab—and third, of fruit that was very scabby. There was also such a noticeable difference in the size of the fruit from the sprayed and the unsprayed trees that the fruit was then re-graded upon the basis of size, in an attempt to determine the amount of this increase. This was done, first, by measuring the fruit with calipers and, second, by weighing it. In measuring the fruit the points of the calipers were set 2½ inches apart and every apple that could be passed between the points was placed in the culls.

The following table shows the result of spraying with Bordeaux both upon the amount of scab and upon the size of the fruit.

Table Showing Effect of Spraying Upon the Amount of Scab and Size of Fruit.

No. of Tree.	Treatment.	Total No. of Apples.	Very scabby.	Slightly scabby.	Free from scab.	No. over 2½ inches in diameter	Weight	No. less 2½ inches in diameter	Weight
1	Sprayed.....	1050	128	110	812	668	180 lbs.	382	71 lbs.
2	Sprayed.....	852	191	139	522	479	125 lbs.	373	56 lbs.
3	Not sprayed	912	737	424	51	334	84 lbs.	578	99 lbs.
4	Not sprayed	1205	909	196	200	320	82 lbs.	883	148 lbs.

To summarize the results: The two trees that were not sprayed bore 215 apples more than the others, but the trees that were sprayed bore approximately ten times as much fruit free from scab as the trees that were not sprayed, or to state it in percentages, on the trees that were not sprayed only 7% of the fruit was free from scab while on those that were sprayed 70% were in a like condition. On the two trees that were sprayed, of the 1902 apples borne, 1147 measured over 2½ inches in diameter and 755 measured less than that. Their total weight was 432 pounds of which 70% was of marketable size. On the trees that were not sprayed, of the 2117 apples borne, only 654 were more than 2½ inches in diameter and 1463 were less than that. Their total weight was only 313 pounds, of which but 53% was of marketable size.

The sprayed trees bore approximately ten times as much fruit free

from scab, and nearly twice as many pounds of fruit over 2½ inches in diameter as did the unsprayed trees.

A study of the above table shows that the fruit on all the trees was small. This was to be expected, from the fact that the orchard has never been properly cared for and during the progress of the experiment received only the most cursory cultivation. Of approximately 2500 boxes of fruit borne by the 400 trees, there were not over 600 boxes of 4 and 5 tier fruit. The small size, however, could not in any way be attributed to the spraying since the figures show nearly twice as much fruit of marketable size upon the sprayed as upon those unsprayed.

The present season the spraying experiments are being duplicated in Mr. Meeker's orchard where other methods of checking scab are being tested.

2. EFFECT OF FREE ARSENIOUS OXID ON FOLIAGE. *

In carrying on this work, the Paris green used was furnished by Mr. J. K. Haywood, Chief Insecticide and Agricultural Water Laboratories, of the Bureau of Chemistry of the United States Department of Agriculture, and the various samples contained known quantities of free arsenious oxid as follows: No. 1, 2.84%; No. 2, 4%; No. 3, 5%; No. 4, 6%; No. 5, 7%; No. 6, 8%.

Four series of the samples, numbered 1, 2, 3, 4, 5, and 6 were used in the work as follows:

Series A. Each sample of Paris green was treated with 9½ gallons of water.

Series B. Each sample of Paris green was treated with 9½ gallons of water to which an equivalent of two ounces of lime had been added in the form of milk of lime.

Series C. Same as "A" except 15½ gallons of water were used.

Series D. Same as "B" except 15½ gallons of water were used.

For each test the required amount of water was first placed in a barrel, the required amount of milk of lime (if any) was then added, followed by the Paris green. The whole was then stirred, thoroughly, and at once sprayed upon the trees. The work was done with a small hand pump fitted with a vermorel nozzle and great care was exercised to see that every leaf was thoroughly sprayed.

Series "A" and "C" were applied Friday, July 10th. The day was hot, dry and windy. Evaporation was so rapid that the foliage

* This work was done in cooperation with the U. S. Department of Agriculture and the results have been published in Bulletin No. 82, Bureau of Chemistry.

was dry in a very few moments after being sprayed. Saturday morning, July 11, the weather conditions were similar and work was resumed. Series "D," Nos. 1-3, were applied. Work was then necessarily interrupted and not resumed until July 17, when the work was finished.

In the meantime the weather had remained clear and bright. A critical examination was made of the trees which had been sprayed on July 10 and 11, but no injury, whatever, could be detected.

Monday evening, July 20, there was a slight shower, followed by slight showers on Tuesday, July 21, and cloudy weather the remainder of the week.

Table Showing Meteorological Conditions During Progress of the Experiment.

Date.	Temperature.			Precipitation.	Character of day.
	Max.	Min.	Mean		
July 10	86	48	67		Clear.
11	70	51	60.5		Do.
12	74	47	60.5		Do.
13	70	52	61		Do.
14	77	47	62		Do.
15	86	48	67		Do.
16	81	50	65.5		Do.
17	82	47	64.5		Do.
18	75	48	61		Do.
19	81	50	65.5		Do.
20	86	50	68		Do.
21	70	50	60	.04	Cloudy.
22	72	47	59.5		Do.
23	66	52	57	.05	Do.
24	74	59	64		Do.
25	75	47	61		Partly cloudy.
26	77	42	59.5		Do.
27	83	45	67		Clear.
28	84	45	64.5		Do.
29	77	54	65.5		Partly cloudy.
30	75	55	66		Clear.
31	77	46	61.5		Do.

Other examinations were made on July 23, August 3 and December 1, the results of which are given in the tabular statement which follows:

Table Showing Effects of Various Amounts of Free Arsenious Acid in Paris Green upon Foliage. Series A and B.
One Ounce Paris Green, 9½ Gallons Water.

Sample No.	Tree.	Variety.	Injury Noted July 23, 1803.	Injury Noted August 3, 2903.	Injury Noted December 1, 1903.
1	Apple$_1$	McIntosh Red	None	None	But few leaves fallen.
1	do	Carolina June	do	do	Do.
1	do	Tuft's Baldwin	do	do	Do.
1	Apple$_2$	Rome Beauty	do	do	Do.
1	do	do	do	do	Do.
1	do	do	do	do	Nearly one-half leaves fallen.
1	Pear$_1$	Directeur Alphando	do	do	Completely defoliated.
1	do	Colonel Wilder	do	do	But few leaves fallen.
1	Pear$_2$	Cockling	do	do	Tree dead.
1	Prune$_1$		do	do	Completely defoliated.
2	Apple$_1$	Benoin	do	do	But few leaves fallen.
2	Crab$_1$		do	do	Completely defoliated.
2	Apple$_1$	Spitzenberg	do	do	No leaves fallen.
2	Apple$_2$	Rome Beauty	do	do	Completely defoliated.
2	do	Waxen	do	do	But few leaves fallen.
2	do	do	do	do	About nine-tenths of leaves fallen.
2	Pear$_1$		do	do	Completely defoliated.
2	Crab		do	do	Do.
2	Prune$_2$		do	do	Do.
3	Apple$_1$	Spitzenberg	do	do	A few leaves fallen.
3	do	do	do	do	Do.
3	do	Spokane Beauty	do	do	Do.
3	Apple$_2$	Waxen	do	do	About nine-tenths leaves fallen.
3	do	do	do	do	Do.
3	Pear$_1$	Bartlett	do	do	A few leaves fallen.
3	Pear$_2$	Buffunn	do	do	Completely defoliated.
3	do	do	do	do	Do.
3	Prune$_1$		do	do	Do.
3	do		do	do	Do.
3	Prune$_2$		do	do	Do.
3	Prune$_1$		do	do	Do.
3	Cherry$_1$		do	do	Do.
4	Apple$_1$	Spokane Beauty	do	do	But few leaves remaining.
4	do	do	Few leaves spotted	No increase.	A few leaves fallen.
4	Apple$_2$	Waxen	None	None	About three-fourths of leaves fallen.
4	do	do	do	do	Do.
4	do	do	do	do	About seven-eighths of leaves fallen.
4	Pear$_1$		do	do	A few leaves fallen
4	do	Patrick Barry	do	do	But few leaves fallen.
4	Pear$_2$	Lincoln	do	do	Do.

Table Showing Effects of Various Amounts of Free Arsenious Acid in Paris Green upon Foliage. Series A and B.
One Ounce Paris Green, 9½ Gallons Water.

No	Tree.	Variety.	Injury Noted July 23, 1903.	Injury Noted August 3, 1903.	Injury noted December 1, 1903.
4	Prune$_1$		None	None	Completely defoliated
4	do		do	do	Do.
4	Prune$_1$		do	do	But few leaves fallen.
5	Apple$_1$		do	do	Completely defoliated.
5	do	Yellow Transpareut	do	do	About one-half of leaves fallen.
5		Grimes' Golden	do	do	Completely defoliated.
5	Apple$_1$	Waxen	do	do	A few leaves fallen.
5	do	do	do	do	About three-fourths of leaves fallen
5	Pear$_1$	Winter Bartett	Leaves slightly injured about margin of holes eaten by slugs	No increase	Completely defoliated.
5	do	Fame	do	do	Do.
5	Pear$_2$	Genesta	None	None	But few leaves fallen.
5	Prune$_1$		do	do	Completely defoliated.
6	Apple$_1$	Hide's King of the West	A few leaves slightly spotted	No increase	But few leaves remaining.
6	do	Langford	A few leaves killed, a few more slightly spotted	do	About one-half of leaves fallen.
6	do	Yakama	do	do	A few leaves fallen.
6	do	Yellow Newtown Pippin	do	do	Completely defoliated.
6	Apple$_2$	Waxen	No injury	None	About seven-eighths of leaves fallen.
6	do	do	Injury slightly greater than on Langford	No increase	About seven-eighths of leaves fallen.
6	Pear$_1$	Genesta	None	None	Completely defoliated.
6	Pear$_2$	do	do	do	About seven-eighths of leaves fallen.
6	do	Assumption	do	do	Completely defoliated.
6	Prune$_1$	Herefordshire	do	do	No record.
6	Peach$_1$		do	do	Completely defoliated.

Series C and D. One Ounce Paris Green, 15½ Gallons Water.

No.	Tree.	Variety.	Injury Noted July 23, 1903.	Injury Noted August 3, 1903.	Injury Noted December 1, 1903.
1	Peach[1]	Old Mixon	None	None	About three-fourths of leaves fallen.
1	Peach[2]	Lewis' Seedling	do	do	Do.
1	do	Imperial	Badly injured	½ leaves fallen	About one-fourth of leaves fallen.
1	Prune[1]	Imperial Epineuse	do	do	Very few leaves remain.
1	do	do	do	do	Do.
1	Prune[2]		do	do	Do.
1	Plum[2]	Rhine Claude	do	do	Completely defoliated.
2	Peach[1]	Old Mixon	Slightly injured	No increase	About one-fourth of leaves fallen.
2	Peach[2]	Imperial	do	do	Do.
2	do	do	do	do	Do.
2	Prune[1]	Imperial Epineuse	do	do	Very few leaves remain.
2	do	do	do	do	Do.
2	Prune[2]	Giant	do	do	Completely defoliated.
2	do	do	do	do	Do.
2	Peach[1]	Old Mixon	do	do	About one-half of leaves fallen.
3	Peach[2]	Mume	Very slightly injured	do	About one-fourth of leaves fallen.
3	do	do	do	do	Do.
3	Prune[1]	Imperial Epineuse	None	None	Very few leaves remain.
3	do	Willamette	do	do	Do.
3	Prune[2]	Brignole	do	do	Completely defoliated.
3	Plum[2]	Green Gage	do	do	About one-half of leaves fallen.
4	Peach[1]	Old Mixon	Leaves considerably spotted	¼ leaves fallen; rest injured	About seven-eighths of leaves fallen.
4	Peach	Alexander	None	None	About three-fourths of leaves fallen.
4	do		do	do	Very few leaves remain.
4	Prune[1]	Willamette	do	do	Completely defoliated.
4	do	do	do	do	Do.
4	Prune	Brignole	do	do	About one-half of leaves fallen.
5	Peach[1]	Mont Rose	Leaves spotted considerably	¼ leaves fallen; rest injured	About three-fourths of leaves fallen.
5	Peach[2]		None	None	Do.
5	do	Willett	do	do	Very few leaves remain.
5	Prune	Willamette	do	do	Completely defoliated.
5	do	do	do	do	But few leaves remain.
5	do		do	do	Do.
5	do		do	do	About one-half leaves fallen.
6	Peach[1]	Mont Rose	Badly injured	½ leaves fallen; rest injured	Do.
6	do	do	do	do	Completely defoliated.
6	Peach[2]	Old Mixon	None	None	Do.
6	Prune[1]	Willamette	do	do	But few leaves remain.
6	do	Robe de Sargent	do	do	Do.
6	Prune[2]		do	do	
6	do		do	do	

[1] Without lime. [2] With lime.

It was hoped that among other things this experiment might throw some light upon the effect arsenious sprays may have upon the time at which foliage is dropped in fall but on this point the results are not definite. The time at which the leaves of the various varieties fall, varies greatly with the season and with the variety. The College orchard consists of two or three trees each of a considerable number of varieties, and when I examined the trees on December first, there was not only a surprising amount of variation in the condition of the foliage of the different varieties, but also of that of different trees of the same variety. Two Waxen trees, standing side by side, were sprayed with No. 2 plus lime. When examined on December first from one of the trees but few leaves had fallen, while on the other not over ten per cent. remained. Likewise two trees of the same variety in the same row, and likewise standing side by side, were sprayed with No. 5 plus lime. When examined, from one three-fourths of the leaves had fallen, from the other but few. Thus, from an examination of the orchard I was unable at the time to see that the sprays had had any effect whatever upon the fall of the foliage. The tabulated data, however, seems to show that a somewhat larger proportion of leaves had fallen by December first from trees that were sprayed with Nos. 5 and 6 than from those sprayed with Nos. 1, 2, 3 and 4. Whether this was due to the sprays or to mere chance in selection of the trees, I am unable to say.

The effect upon apple, pear and prune, if any, was very slight.

CONCLUSIONS.

Judging from the results of this set of experiments alone I should say that under the favorable conditions which prevailed at the time the work was performed, and during the next 30 days, it is safe to spray apple, pear and prune trees with any of the samples sent. I should say that none of the samples injured any of the varieties of these fruits sufficiently to be considered of practical importance in orchard work. It may be probable, however, that the work was done under peculiarly favorable conditions. Probably not over 15 minutes elapsed in any case from the time the poison was mixed in the water until it was sprayed upon the trees, thus giving but a very short time for the arsenious oxid to enter into solution; and the weather conditions were such that after being sprayed upon the trees the mixture evaporated very rapidly. Under practical orchard

conditions, and under ordinary climatic conditions it would probably be safer not to use Nos. 5 and 6 upon apple, prune and pear without the addition of the lime.

So far as the peach is concerned, I believe that no conclusions can be drawn from this series of experiments. The peach trees in the College orchard are growing upon soil entirely unsuited for this fruit. The trees are unthrifty, many of them nearly dead, and I am under the impression that the resistance of the foliage of the various trees to the action of soluble arsenic varies greatly.

SAN JOSE SCALE.

The rapid spread of the San Jose Scale, during the past three years, in the villages and neglected orchards of Western Oregon has been one of the most notable entomological events of this part of the state. Experienced orchardists have for a number of years relied upon the lime, sulphur, salt or the lime sulphur, copper sulphate sprays as a remedy for this pest and have had comparatively little difficulty in reducing the loss from its ravages to a minimum. The recent spread of the pest, however, together with the fact that a number of other remedies, both tried and untried, and a number of new methods of preparing the old sprays, have received premature publicity has resulted in such a demand for information that it was decided to make this one of the chief lines of work for the year. Accordingly after an examination of various sections, arrangements were made for carrying on a series of cooperative spraying experiments for the San Jose Scale in the twelve acre apple orchard of Mr. F. D. Evans, at Umpqua Ferry, Oregon. Mr. Evans had found this orchard unprofitable, and had neglected it for several years with the result that every tree was completely encrusted with the scale and many of them nearly dead. During the progress of the experiment observations have been made upon the relative efficiency of twelve different spraying compounds.

Through the courtesy of Dr. L. O. Howard, Entomologist of the U. S. Department of Agriculture, I received early last fall between thirty and forty of the Chinese lady birds which had been bred from specimens imported from China. In their native home these beetles prey so actively upon the scale that it became of but little economic importance. The specimens received were liberated in an abandoned and badly infested pear thicket on one of the ranches of Mayor E. Britt, of Jacksonville, Oregon.

A bulletin giving the results of the above experiments will be issued during the coming winter.

CROWN GALL.

Crown Gall, a serious fungous disease of fruit trees, is becoming more and more prevalent in the fruit growing sections of the State. Through the courtesy of Mr. R. H. Weber, Horticultural Commissioner at The Dalles, I learned of a very badly diseased orchard at that place. On visiting the premises, I found that they afforded unusually fine opportunities for experimental work with methods of preventing and curing the disease, and accordingly entered into an agreement by which the owner, Mr. Weber, and myself have carried on the work co-operatively. A. B. CORDLEY.